In the outstanding Office Action, Claims 8-10 were rejected under the second paragraph of 35 U.S.C. § 112 as being indefinite, Claims 1, 3, and 5 were rejected under 35 U.S.C. § 102(b) as being anticipated by Scifres et al. (U.S. Patent No. 4,984,242, hereinafter Scifres), Claims 2 and 8 were rejected under 35 U.S.C. § 103(a) as being obvious over Scifres in view of Inoue et al. (U.S. Patent No. 5,019,874, hereinafter Inoue), Claims 4 and 6 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Scifres in view of Sugawara et al. (U.S. Patent No. 5,153,889, hereinafter Sugawara), and Claims 5, 7, 9, and 10 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Scifres in view of Sugawara and further in view of Inoue.

In response to the rejection under the second paragraph of 35 U.S.C. § 112, Claims 8-10 have been amended to recite a "dense defect layer," instead of just a "dense layer," and the recitation of "the value of the lattice constant is 10^{-2} or greater" has been removed. Accordingly, it is believed that this ground of rejection has been overcome as indicated during the interview of June 4, 1997 and so recorded on the Examiner Interview Summary Record relative thereto.

Before discussing in detail the prior art rejections applied as to Claims 1-10, it is believed that a brief review of the present invention is in order.

The present invention is directed to the placement of a dense defect layer within a semiconductor light emitting device having a hetero-configuration (an active light emitting layer sandwiched between two clad layers) so as to protect all of the layers of the hetero-configuration from remotely originating crystal defect migration. Note, for example, in Figures 2 and 4b which show the hetero-configuration as a of lower clad layer 14, active light emitting layer 15, and an upper clad layer 16 separate from a dense defect layer 30. Page 6,

lines 24-37 of the specification, for example, discuss the showing of Figure 1 while, for example, page 11, lines 1-5 describe how secondary crystal defects are prevented from migrating to the hetero-configuration of active layer 15 sandwiched by the clad layers 14 and 16 as illustrated in Figure 4b. Thus, it is Applicant who discloses that this dense defect layer placement completely outside all of the layers of the hetero-configuration is advantageous because the dense defect layer can then safeguard the entirety of the hetero-configuration layers from secondary crystal defects migrating or extending to any part of these hetero-configuration layers after, for instance, heat processing associated with resin packaging of the semiconductor light emitting device induces crystal defects in surface regions and other regions external to the hetero-configuration layers. Note, for example, page 10, lines 4-14. Moreover, Applicant's determination of the superiority of providing the dense defect layer as a layer completely outside the clad layers is noted at page 11, lines 21-24, for example.

Turning to the rejections of Claims 1-10 based upon the teachings and/or fair suggestions of Scifres, it is noted that independent Claims 1, 6, and 7 all require that there must be a "dense defect layer provided between the first electrode and the layers of the hetero-configuration" (emphasis added) with this dense defect layer being made of a material described in these independent claims as at least preventing "some of the crystal defects generated remotely from the layers of the hetero-configuration from reaching the layers of the hetero-configuration (emphasis added)." Thus, these independent claims require that all of the hetero-configuration layers must be separated from the first electrode by the dense defect layer so that it can function to prevent at least some remotely generated defects from reaching any of the layers of the hetero-configuration, not just the active layer as noted at page 3 of the present Action. Moreover, each of these independent claims require that the clad layers of

the hetero-configuration must each have "approximately equal layer thickness" to function "to keep the injected charge carriers in the active layer."

In sharp contrast, Scifres teaches that clad layer 25 of its hetero-configuration is provided with a strain inducing component to form strain layer 27 internally of clad layer 25. This is discussed at col. 4, lines 31-50 as to a "selected high concentration of indium" being added to the cladding layer 25 "to produce the strain layer 27." This is the changing of the "stoichiometry of the cladding layers" discussed at column 2, lines 47-55. Thus, contrary to Applicant's claimed subject matter and the disclosed advantages achieved thereby, Scifres teaches adding strain layer 27 inside of the cladding layer 25 which means a portion of cladding layer 25 cannot be protected by layer 27 as the claims all require. The result of placing layer 27 inside the cladding layer is clearly further inferior, as noted at page 11, lines 21-24 of the specification, for example, besides not being capable of performing the function claimed.

Clearly, all of layer 25 is described by Scifres as a cladding layer. Such a cladding layer does not cease to become part of the hetero-configuration merely because indium has been added to a part thereof to create a strain field relative to the small modified portion 27 which is still internal to the overall cladding layer. The rule is well established that "claims are not to be read in a vacuum, and limitations therein are to be interpreted in light of the specification in giving them their "broadest *reasonable* interpretation" (In re Okuzawa, 190 USPQ 464 (CCPA 1976) citing In re Royka, 180 USPQ 580 (CCPA 1974)). Thus, the apparent reading of only the part of cladding layer 25 as being part of the hetero-configuration is not a "reasonable" interpretation of the subject matter of the independent claims read in light of the specification, much less is it consistent with what Claim 1 states

and what has been disclosed in terms of what constitutes a "hetero-configuration" and a "clad layer." Note also In re Sneed, 218 USPQ 385, 388 (Fed. Cir. 1983) which emphasizes that the bounds of reasonableness are set by the specification as it would be interpreted by those of ordinary skill in the art. Also, this reading of only a part of layer 25 as the cladding layer of Scifres is at odds with Scifres itself because of the disclosure of layer 25 as functioning as the cladding layer regardless of whether or not the strain layer is induced into this cladding layer. Note Claims 1 and 4 of Scifres. The attempt to read only the portion of the cladding layer 25 between the strain layer and the active region 29 as a complete cladding layer component of the Scifres hetero-configuration is clearly the type of "conjectural modification" noted to be improper in Carl Schenck, A.G.v. Nortron Corp., 218 USPQ 698,702 (Fed. Cir. 1983) because it is unwarranted by the disclosure of the reference. Consequently, the interpretation being offered is unreasonable because it ignores both what Claim 1 and the specification indicate in terms of what reasonably constitutes a "hetero-configuration" and a "clad layer" as well as what Scifres defines his cladding layer to be.

In addition, the interpretation offered as to Scifres ignores the function required of the "first dense defect layer" as to the protection of the "hetero-configuration" in terms of preventing at least some defects from reaching any layer in that "hetero-configuration." It is well established that all of the claim limitations, including the functional language therein, must be given effect. See MPEP §2173.05(g) and In re Angstadt, 190 USPQ 214, 217 (CCPA 1976). Clearly, it is unreasonable to attempt to read the claimed "first dense defect layer" as a layer made up of defect inducing component introduced into the material of the clad layer to change its stoichiometry in light of the usage in the specification with particular regard to the prohibition of page 11, lines 21-24 of the specification.

Moreover, it is clear that Scifres contemplates the use of cladding layers having typical thicknesses of 1 μm as disclosed at col.3, lines 55 and 56. On the other hand, col. 5, lines 16-20 note that strain layer 27 is typically at least 0.5 μm away from the active layer region 29. Accordingly, the Scifres layer portions 25 divided by layer 27 are not each separately capable of performing the cladding layer function and they would not be each provided with the same thickness of cladding layer 31, unless that layer was being implemented with only half of its typical thickness, an unreasonable presumption.

Consequently, the rejection of Claims 1, 6, and 7 over the teachings and/or fair suggestions of Scifres is clearly misplaced and should be withdrawn as relying upon an unreasonable interpretation of Scifres.

Claims 2 and 8 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Scifres in view of Inoue. This rejection is traversed because Inoue cures none of the deficiencies noted above as to Scifres. In addition, the present Office Action fails to present any reasonable motivation which would have led the artisan to combine these two references relative to the subject matter of Claims 2 and 8.

In this last regard, the present Office Action suggests that Inoue teaches the use of multiple defect regions to limit defect migration relative to the Abstract. However, this is a clearly oversimplified and misleading statement that fails to take the teachings of the Abstract in context, much less demonstrating the required consideration of the reference teachings as established by the courts. Note In re Wesslau, 147 USPQ 391, 393 (CCPA 1965) which establishes it to be clear error "to pick and choose from any one reference only so much of it as will support a given position, to the exclusion of other parts necessary to the full appreciation of what such reference fairly suggests to one of ordinary skill in the art."

In order to fully appreciate the teachings of Inoue, it is necessary to consider its concern with providing semiconductor devices including epitaxial layers provided on substrates of different semiconductor materials. In this regard, the problem noted by Inoue is that an epitaxial layer of a compound semiconductor (such as gallium arsenide (GaAs)) which is grown on a silicon (Si) wafer contains a substantial amount of dislocations because of the differences in lattice constant and coefficients of thermal expansion between GaAs and Si. Note column 1, lines 41-47. This results in what is called a slip or misfit in the crystal lattice of Si and GaAs at the heterojunction interface which propagates into the epitaxial layer as dislocations. See column 1, lines 47-53. Inoue resorts to creating canceling dislocations in order to correct the problem as discussed at column 2, lines 47-67. This use of multiple defect regions to limit defect migration by cancellation is entirely different than the attempted blocking of defects with the induced strain layer of Scifres. The Office Action would erroneously lift the "preventing a first group of dislocations created in the third semiconductor layer from reaching the second semiconductor layer" of the Abstract of Inoue totally out of this cancellation prevention context and into the completely foreign territory of strain layer defect migration blocking taught by Scifres. However, the present Office Action presents no convincing reasoning or rationale which is based upon logic as to why such divergent approaches would have led the artisan to modify Scifres so as to "include a second strain layer to supplement the buffer region" as noted on page 3 of the present Office Action. The requirement for a "logical reason apparent from positive , concrete evidence of record" is well established. See In re Regel, 188 USPQ 136, 139, n. 5 (CCPA 1975).

Moreover, since Fig. 3 of Scifres already includes two strain layers 47 and 49 in clad layers on either side of the active region, the required showing of a logical reason why these

layers on either side of the active layer would be abandoned is doubly lacking. The logic of eliminating layers 47 and 49 which are said to improve performance (col. 5, lines 35-38) and then adding layers to somehow supplement this lost performance does not appear to be logical. Accordingly, clear error is again believed to be present.

In any event, it is unclear where the alleged benefit at the bottom of page 3 of the present Office Action ("supplement the buffer region") is taught by Inoue and the Action, thus, fails the burden placed on the PTO by In re Rijckaert, 28 USPQ2d 1955, 1957 (Fed. Cir. 1993) ("when the PTO asserts that there is an explicit or implicit teaching in the prior art, it must indicate where such a teaching or suggestion appears in the reference" (citation omitted)). Also lacking in the present Action is any indication as to what would have led the artisan to have supplemented, apparently to limit defect migration, a prior art "graded buffer layer" of col. 3, line 37 (between the substrate and the prior art cladding layer 13 of Fig. 1) absent any suggestion that this prior art "graded buffer layer" is for limiting defect migration in the first place.

In addition, the apparent reliance upon the "dislocation density" teachings of Inoue, which relates to the density of the misfits or dislocations being propagated, in terms of teaching the claimed concentration of crystal defects induced into the dense defect layer of Claims 8 represents another clear error. First of all, the Abstract, which was noted as being the source of teachings to be considered relative to Inoue, has no defect density or dislocation density teachings. Secondly, the page 4, paragraph 11 assertion of the present Action that a defect density range of $10^6/cm^2$ is taught appears to be a misstatement of the dislocation density teaching of col. 5, lines 30-31 ("dislocation density in the order of 10^6 /cm^{-2}"). Accordingly, it is clear that the crystal defect density limitation of Claims 8 is not taught by

Inoue just as it is clear that there is no demonstrated motivation for combining the defect cancellation teachings of Inoue with the totally inconsistent defect blocking structures and teachings of Scifres.

The establishment of a *prima facie* case of obviousness requires a showing of some objective teaching or generally available knowledge that would have led one of ordinary skill in the art to combine the referenced teachings in the exact manner to obtain the subject matter of Claims 2 and 8. Note In re Fine, 5 U.S.P.Q.2d 1596, 1598 (Fed. Cir. 1988). Moreover, the Fine decision emphasizes (at page 1600) that the purposes behind the teachings being said to be combined must be considered and where these purposes are entirely unrelated, a combination of such reference teachings is not reasonably taught. In addition, this decision notes that it is "error to find obviousness where references 'diverge from and teach away from the invention at hand'" (at page 1599). Not only are the teachings of Scifres inconsistent with the claimed invention, the teachings of Inoue are inconsistent therewith as well as being inconsistent with those of Scifres. Clearly, the 35 U.S.C. §103 rejection offered based upon these references as evidence of obviousness is misplaced. Accordingly, it is believed that this rejection should also be withdrawn for this reason.

The rejection of Claims 4 and 6 under 35 U.S.C. §103(a) as being unpatentable over Scifres in view of Sugawara is traversed. First, Sugawara cures none of the deficiencies noted above as to Scifres. Second, the present Office Action appears to rely upon Sugawara to show structure recited by Claims 4 and 6 and further suggests that the artisan would have been led to modify Scifres with this structure to achieve a "more uniform output," "increased reliability," and better "performance." Once again, however, the present Action fails to explain how the teachings of Sugawara and Scifres would lead to such expectations. This

rejection is also clearly in error and also should be withdrawn.

The rejection of Claims 5, 7, 9, and 10 under 35 U.S.C. §103(a) as being unpatentable over Scifres in view of Sugawara and Inoue is also traversed. Once more, the required showing of a reasonable and logical basis for the proposed combination of reference teachings is missing and broad generalizations which are not shown to apply to the teachings extracted are substituted. Moreover, the above comments as to the uncombinability of the teaching of Scifres and Inoue are herein repeated due to the above-noted incompatibility of these two references. Clearly, since no *prima facie* case of obviousness has been set forth relative to the references being relied upon, the withdrawal of this rejection is also in order.

Since no other issues are believed to be outstanding in this case, the application is believed to be in condition for formal allowance, and an early and favorable action to that effect is respectfully requested.

Respectfully submitted,

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